CARGO HANDLING EQUIPMENT FOR LOADING COMBATANT SHIPS

EVALUATION OF MATERIALS HANDLING EQUIPMENT FOR UNDERWAY REPLENISHMENT OPERATIONS ON USS SALEM (CA-139)

BAYONNE, NEW JERSEY

RESEARCH AND DEVELOPMENT DIVISION
BUREAU OF SUPPLIES AND ACCOUNTS
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TECHNICAL REPORT REVIEW

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Project NT003-011(q)
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Engineering Report #2.1053 (Report #2)
15 July 1955

by

Commander R. E. S. E. Fullam, SC, USN
Supply Engineering Officer

Commander W. C. Humphrey, SC, USN
Officer in Charge

ABSTRACT

Materials handling equipment as enumerated below was installed in the USS SALEM (CA-139) and was evaluated during the underway replenishment of provisions, general stores, clothing and small stores, and ship's stores stock, conducted with the units of the Sixth Fleet in the Mediterranean Sea during Log-Rep 11, May 1955:

1. Vertical tray lift conveyor, platform type, 1 each.

2. Gravity conveyors, skate wheel type, aluminum, 12 inches wide, in lengths of 10 feet, 60 each.

3. Gravity conveyors, skate wheel type, aluminum, 12 inches wide, in lengths of 5 feet, 11 each.

4. Aluminum chutes, telescopic, with retarder tape, 11 each.

5. Vertical canvas chutes, baffle retardent, 3 each.

This equipment demonstrated in an outstanding manner its ability to increase the over-all efficiency of this receiving combatant ship to accept, segregate and strike below decks cargo from the delivering ship, while reducing a number of personnel involved from approximately 950 to 450 and achieving the standards for the underway replenishment operation as set forth by the Commander, Sixth Fleet.

Increases in the amounts of equipment furnished were warranted in order to obtain even better results, and this additional equipment in the form of gravity conveyors, telescopic metal chutes and vertical canvas baffle retardent chutes were sent to the USS SALEM (CA-139) in time for the Log-Rep 13 of June 1955.

Additional data pertaining to this equipment is available as Naval Supply Research and Development Engineering Report No. 2.1053 (Report No. 1) entitled "Specifications, Placement and Use of Materials Handling Equipment Aboard USS SALEM (CA-139) and Destroyers of Destroyer Division 142 Previous to Evaluation During Med.Log.Rep No. 11, May 1955".

SUMMARY

PROBLEM

The cardinal military essential to be achieved by the receiving ship during the underway replenishment operation is expressed by the Commander, Sixth Fleet, in paragraph 4 of his letter, Ser 061, Dated 11 February 1955 and is herewith quoted verbatim.

"In the case of receiving ships, the requirement is that the ship be organized to replenish at sea rapidly, accepting cargo at the rate transferred by the delivering ship; and also, that the cargo be sorted, segregated and struck below at about the same rate as the cargo is received, while simultaneously maintaining a state of combat readiness approximating that of 'general quarters'."

Prior to the installation of materials handling equipment in the USS SALEM (CA-139), the underway replenishment operation made the use of extensive manpower imperative. Therefore, it was required that if the operation was to be accomplished with any reasonable degree of rapidity, some 900 to 950 men be assigned during the phase of the operation.

Without materials handling equipment it was obviously necessary that each item be handled individually and manually. The very nature of such an operation, utilizing as it did over 900 men, precluded even an approach to the standards required by the Commander, Sixth Fleet, and so long as such a system remained in effect, the standards could only remain as a basis for academic discussion.

FINDINGS

The results of testing the equipment in the USS SALEM (CA-139) during replenishment operations in the Mediterranean during Log-Rep 11, May 1955, testified that the intelligent utilization of the equipment reduced by four hundred the personnel involved, per-

mitted a continuous flow pattern to be maintained, caused cargo to be struck below as it was received, and permitted the ship to maintain a state of combat readiness approximating "General Quarters".

A striking example of the success of the equipment was the performance of the vertical cargo lift conveyor. Heretofore some thirty tons of potatoes had to be hoisted by line to the 02 level from the main deck, an operation which required some five to six hours and alternate shifts of men. By the use of the conveyor, the same tonnage of potatoes could be hoisted in one to one and a half hours, with less manpower and fatigue. The conveyor deposited crates on the 02 level from the main deck at the rate of sixteen per minute.

A total of 110 tons of provisions were received by the USS SALEM (CA-139) in three hours and four minutes, and all tonnage was struck below at the time of receipt. Thus, the results of the equipment tests should be considered an unqualified success.

RECOMMENDATIONS

It is recommended that such items of materials handling equipment as may be required to fit the particular demands of receiving ships be made a part of the Allowance List of such ships and be furnished on a demand basis.

It is further recommended that an Underway Replenishment Bill be prepared by each receiving ship and that it be accepted as an integral part of the internal organization of the ship.

It should be recognized that such a Bill is of paramount military importance, detailing as it would the requirements of all concerned in the operation, and the procedures to be followed, if the replenishment evolution is to be accomplished with optimum efficiency and a minimum of personnel and effort.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

EVALUATION OF MATERIALS HANDLING EQUIPMENT FOR UNDERWAY REPLENISHMENT OPERATIONS ON USS SALEM (CA-139)

INTRODUCTION

Underway replenishment, as we know it today, had its inception during World War II, but its influence on the mobile logistics support concept was probably not fully realized until the outbreak of the Korean War in June 1950. During the early campaigns of that war the urgent need for specific materials handling equipment to implement the effective replenishment at sea methods was voiced by CAPT (then CDR) T. A. Long, SC USN, at that time Logistics Officer for Commander Service Squadron THREE.

Replenishment at sea procedures, and equipment pertaining thereto, have been tested more recently with units of the Sixth Fleet under the direction of CAPT E. D. Stanley, Jr., SC USN, Logistics Officer for the Commander, Sixth Fleet. Under his direction underway replenishment has reached a high degree of efficiency and, while much has been done to improve methods, procedures, and procure necessary equipment, much still remains to be done.

The ability of a ship to replenish underway is an essential military characteristic, and the ability of a fleet to maintain itself and operate in any given area is largely dependent upon the proficiency it can assume during the underway replenishment evolution.

Heretofore, the investigations conducted in the field of underway replenishment techniques, and the improvements accomplished, have been to a large degree confined to delivering ships. The successful development of the vertical pocket lift conveyor by the U. S. Naval Supply Research and Development Facility for use on the delivering ships eliminated to a great extent the difficulties peculiar to these ships, and by increasing the rapidity of transfer and increasing the rate of tonnage transferred to the receiving ships created a demand for improvements in replenishment techniques on the receiving ships inasmuch as the ability of the delivering ship to transfer tonnage exceeded, as a general rule, the ability of the receiving ship to accept the cargo, segregate, and strike below decks, even though it was the rule rather than the exception for receiving ships to operate on an all hands evolution basis.

In order, therefore, to overcome the difficulties anent replenishment and inherent in the receiving ships, the Commander, Sixth Fleet in his letter dated 11 February 1955, Serial 061, set forth certain standards to be met during the underway replenishment evolution, and these standards postulated the intelligent use of materials handling equipment.

The standards of the Commander, Sixth Fleet are the result of extensive studies conducted during underway replenishment operations and permit the combatant ships involved to assume an offensive and defensive posture, to maintain an adequate degree of logistic readiness consistent with economy of time and support shipping, and to be employed as may be expected in the event of a general war.

These standards are enumerated below and their successful achievement permits the receiving ship to replenish underway while simultaneously maintaining a state of combat readiness approximating that of "general quarters".

1. Replenishment evolutions will be conducted with a minimum interference with combat readiness.

2. The removal of cargo from transfer stations and the stowage of supplies will be conducted at the highest hourly tonnage rates consistent with safety.

3. The operation is to be conducted in a minimum time.

4. The operation is to be conducted with a minimum of personnel, consistent with other considerations.

The complete evaluation of the equipment used in the USS SALEM (CA-139) during the replenishment at sea operations is covered in this report. The equipment was used originally during underway replenishment operations conducted by the Sixth Fleet in May 1955. The operations were witnessed by CDR R. E. S. E. Fullam, SC, USN, Supply Engineering Officer of this Facility, and the results of his observations form the basis of conclusions and recommendations in this report.

Four types of equipment were evaluated: (1) a vertical tray lift conveyor, (2) gravity roller conveyors, (3) metal chutes with retardent tape, and (4) canvas baffle chutes for vertical move-

systems. Each type of equipment will be described and evaluated separately in this report.

VERTICAL TRAY LIFT CONVEYOR

General Description

The main operational feature of the Vertical Tray Lift Conveyor, platform type, is that the lifting platforms, when in the lifting position, are in a horizontal plane and as they pass over the topmost point of the conveyor they assume a vertical position for their downward movement. (See Figs. 1 and 2).

This peculiar feature permits a compact design and permits installation on ships within exceptionally limited space. Its installation in the USS SALEM (CA-139) on a temporary basis demonstrated this fact. (See Figs. 3, 4, and 5).

Used primarily to hoist crates of potatoes from the main deck to the 02 level, it is designed to lift boxes 19 inches square by 36 inches in height maximum size carrying loads of one hundred pounds.

1. The trays are on a 43 inch center to center distance along the chain.

2. The trays are manually loaded, waist high, with automatic pickup and the machine was geared to hoist sixteen trays per minute, or at a maximum rate of 48 tons per hour.

3. The discharge, at the topmost point of the machine, was by manual removal.

4. During its operation, the equipment was used to capacity only at short intervals because of occasional interruptions in the flow of crates.

5. The operation of the machine can be reversed and crates or bags lowered at the same rate. (See Fig. 6).

Control

Control of the machine is maintained at both upper and lower levels. An enclosed box on the lower level contains a reversing magnetic starter with differently coloured push buttons marked UP/DOWN/STOP, and on the upper level, STOP. Thus, control is exercised at both levels. (See Fig. 7).

The lift in the USS SALEM (CA-139) was at a height of 17' 4", but the machine can be built to fit particular heights on an, "as desired", basis.

Construction

The machine is a portable type conveyor. The frame consists of angle iron, number 14 gage sheet guard over the drive chain, and number 16 gage sheet guard around the conveyor. (See Fig. 8).

As the lifting trays approach the top of the conveyor the attached roller cams, by movement in their restraining channels force the trays to assume a vertical position for their downward travel. As the vertical trays reach the bottom of their travel the roller cams move the trays from a vertical to a horizontal position for loading on the upward travel.

The special feature of the tray control, which allows them to assume a vertical position on their downward travel, is a great space saver.

The packages are loaded manually to the trays 22" from the deck. The discharge is 17' 4" high through the top of the unit. The discharge is also manual.

The Vertical Tray Conveyor is designed to rotate at a speed of 16 trays per minute. Carrying 100 lbs. one unit will deliver 48 short tons per hour.

The Vertical Tray Lift Conveyor is a development of the Kornylak Engineering Company, 517 Communipaw Avenue, Jersey City, New Jersey. Its basic characteristics are as follows:

1. Serial Number: VTC 1

2. Manufacturer's Serial Number: 1337

3. Drive: Electric. 1/2 H.P. Totally enclosed. 220/440 Volt - 3 Phase - 60 Cycles - Gearhead Motor with chain to conveyor drive shaft. Reversing magnetic starter with UP/DOWN/STOP station at lower level and STOP station at upper level.

4. Capacity:

a. Maximum packages size 19" x 36" high by 100 lbs.

b. Trays on 43" center to center distance along the chain.

5. Speed: 16 trays per minute. However, sprocket spares are supplied and can be installed to obtain either of the following speeds: 10-1/2 trays per minute and 20 trays per minute.

6. Lifting Rate:

a. Lifting 100 lb. crates at the rate of 16 trays per minute; 48 tons per hour.

b. Lifting 100 lb. crates at the rate of 20 crates per minute; 60 tons per hour.

c. Lifting 100 lb. crates at the rate of 10-1/2 trays per minute; 36-1/2 tons per hour.

7. Loading Height: Manual load to tray 22" high with automatic pickup by tray.

8. Discharge: 17' 4" high through topmost point, with manual removal of crates.

9. Dimensions: Body 34" wide by 30" front to back. Height - 17' 4".

10. Guards: Number 14 gage guard over drive chain. Sixteen gage housing around conveyor, angle iron guard at top to prevent crates from falling off carriers.

11. Weight: 2,000 lbs.

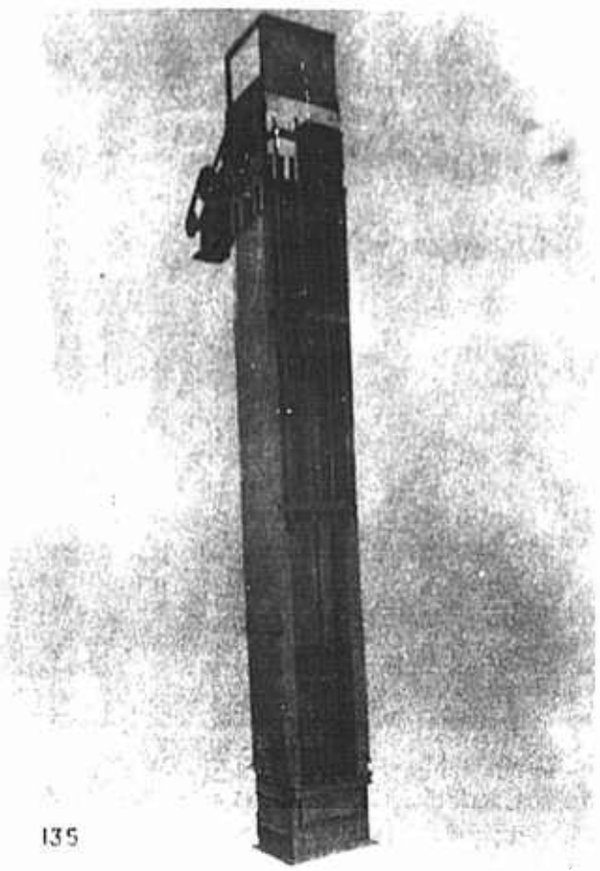


Fig. 1. - General over-all view of the vertical tray lift conveyor currently installed in the USS SALEM (CA-139) to effect the movement of supplies from the main deck to the 02 level. Reversing features permit discharge from 02 level to main deck. Note guards along upper portion to prevent packages from falling. NSRDF Neg. No. 290-1.

Fig. 2. - View showing the discharge section of the tray lift conveyor. Note that as the package approaches, it is manually removed from the unit. The lifting tray then changes from a position at right angle to the axis of the conveyor to a position parallel to the unit. NSRDF Neg. No. 290-8.

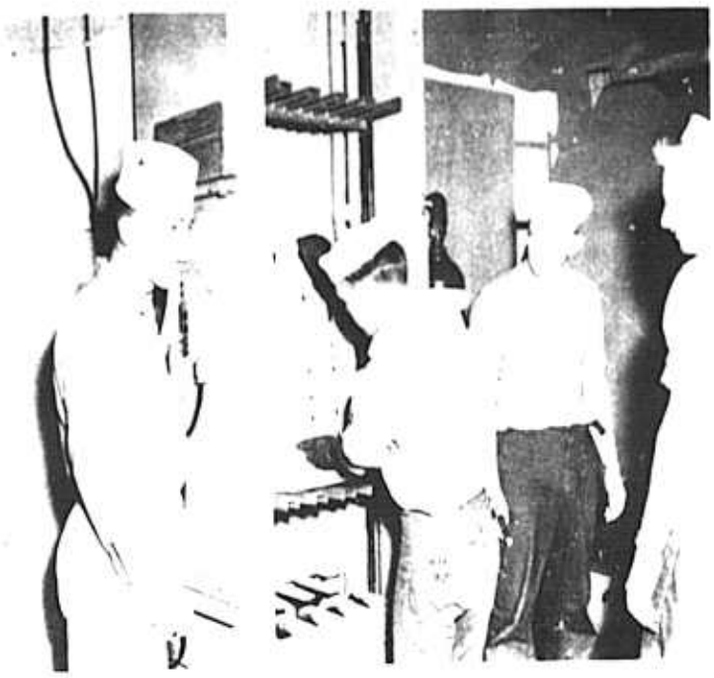


Fig. 3. - The tray lift conveyor in operation. View of the lower level with man stationed at the control. NSRDF Neg. No. 323-1.

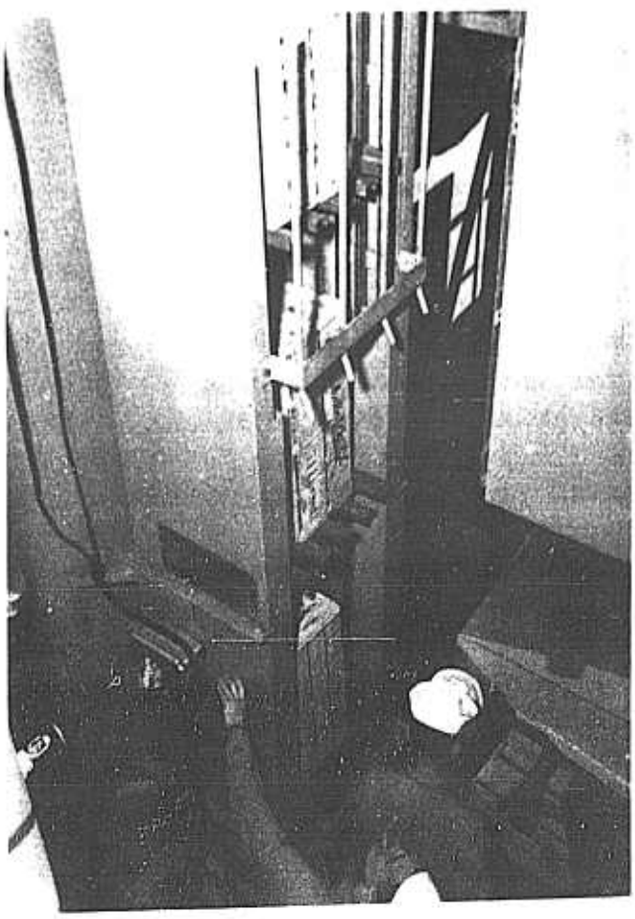


Fig. 4. - View of the loading level of the tray lift conveyor. Conveyor is in operation and the rate is sixteen trays per minute. Note man in foreground with hand over control buttons. NSRDF Neg. No. 309-38.

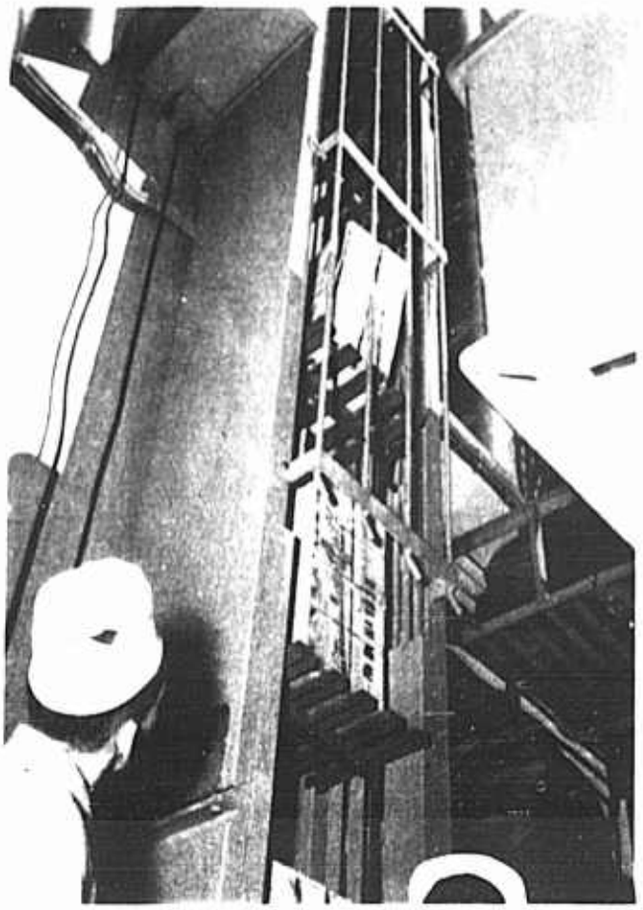


Fig. 5. - View of tray lift in operation looking from main deck to the 02 level. NSRDF Neg. No. 309-39.

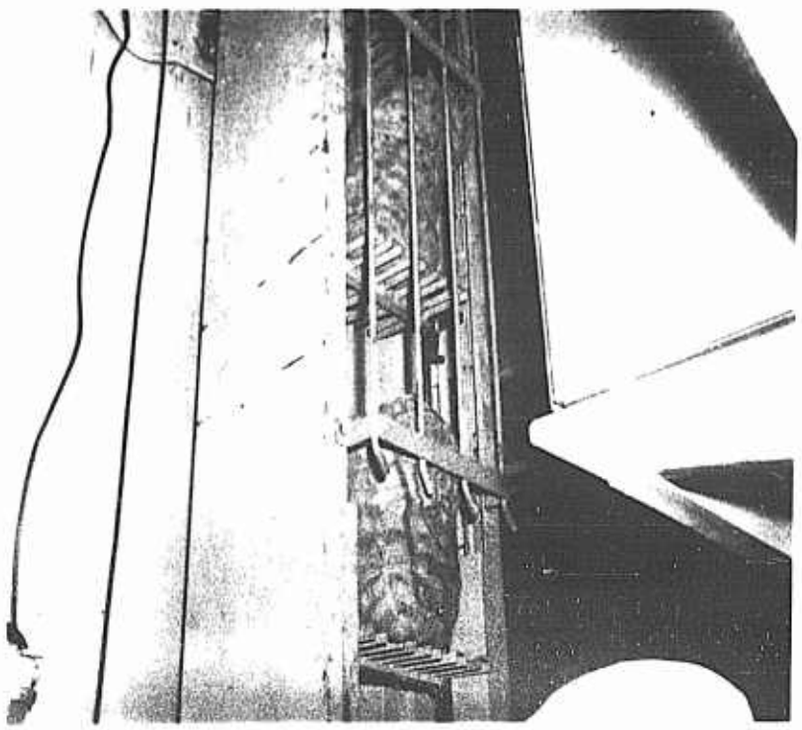


Fig. 6. - The operation in reverse. View showing sacks of potatoes being lowered from the 02 level to the main deck. NSRDF Neg. No. 309-76.

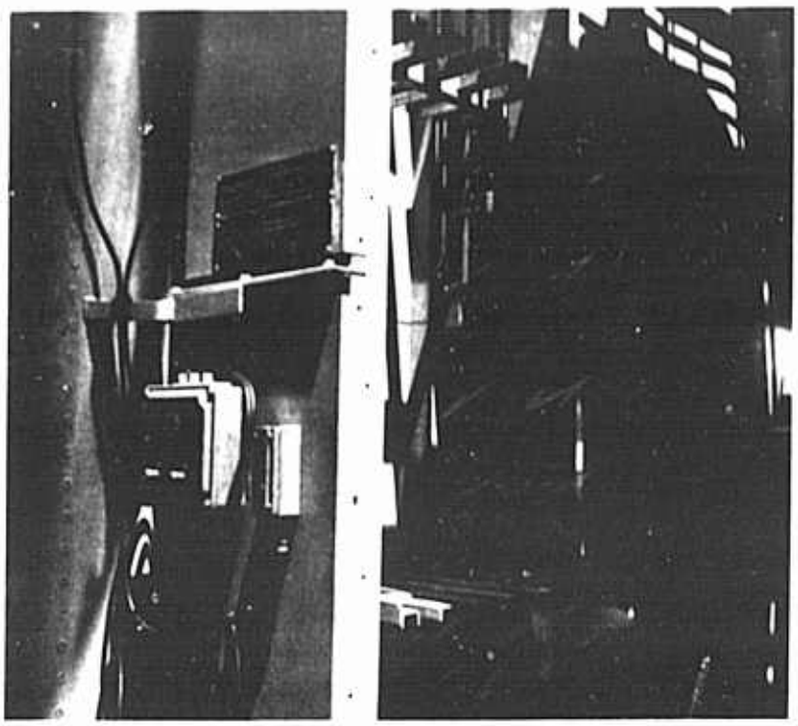


Fig. 7. - View showing the control station on the lower level. The buttons are labeled FORWARD/REVERSE/STOP. NSRDF Neg. No. 309-17.

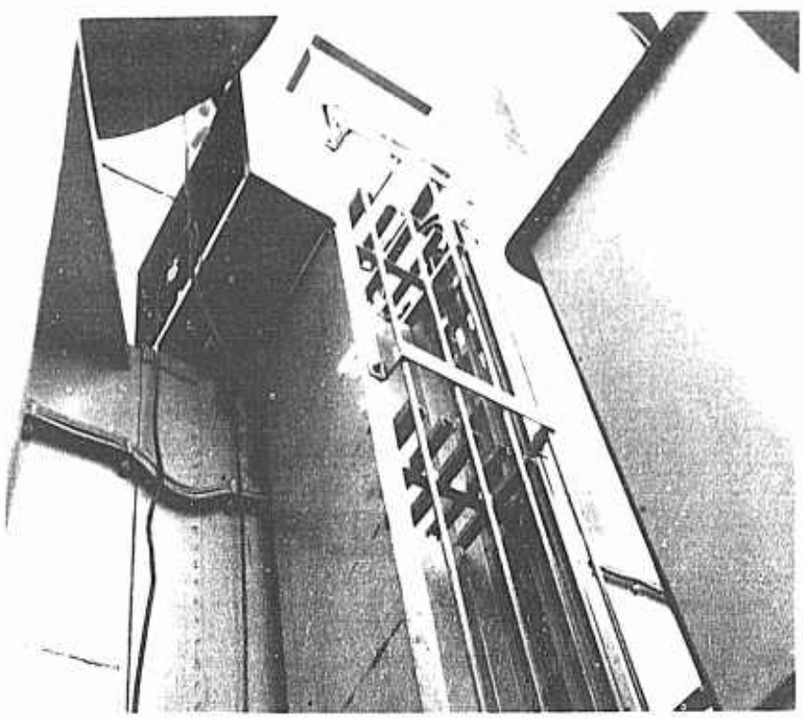


Fig. 8. - View of the discharge section of tray lift conveyor looking from main deck to the 02 level. Note sheet metal and bar type guards used to prevent packages from falling. NSRDF Neg. No. 309-11.

No 45° or 90° fabricated turns were furnished because judicious overlapping of straight lengths serves the same purpose just as efficiently for combat ship use.

Construction

Conveyors are made of aluminum alloy (61 ST) and conform to Federal Specification QQ-A-327a, 21 June 1951, unless otherwise specified. The side rails of the conveyor consist of two formed aluminum alloy channels .125" thick. The channel sections have a web of 3-1/2" with 1" flanges. The ends of each flange are rounded off and dropped forged to prevent the tearing of overhanging packages. The side rails are mounted parallel to each other with the flanges turned to the outside of the conveyor. Further, the side rails are aligned and adequately braced by means of three or more cross members for a 5' section and five or more cross members for a 10' section. These members are made from formed extruded aluminum alloy and are securely fastened to the side channels by means of two through bolts for each member. The cross members are spaced between the first and second set of wheels at each end of the conveyor and uniformly in between. One-quarter inch diameter holes are spaced at 3" centers to receive the wheel axles. There are holes for 20 axles in a 5' section and 40 axles in a 10' section.

Three aluminum longitudinal strengthening bars 1" x .125" are spaced between the channel frames for 12" wide conveyors.

The wheels are made of cadmium plated steel and have a diameter of 2" and a face of not more than 5/8". They have hardened inner and outer raceways and are free running. The design of the hub is of the baffle or labyrinth type to keep grease in and dirt and water out. The construction of the complete assembly is so constituted to prevent salt water corrosion during use and during its storage at sea. The wheels are mounted on 3" centers, 16 per foot for 12" wide conveyors.

Five foot sections of this type of conveyor will hold 1,050 lbs. if the conveyor is supported at each end, and under the same circumstances a ten foot section will hold 525 lbs.

The five foot sections of the assembly have a total weight of 25 lbs. and the ten foot sections of the assembly have a total weight of 50 lbs., and, therefore, the spotting of the equipment, its removal and stowage after use is a matter of easy accomplishment.

The photographs which follow show the contrast between the intelligent application of the lightweight aluminum conveyors used on the USS SALEM (CA-139) during Log-Rep 11, and the use of conveyors alone. (See Figs. 9-13).

Fig. 9. - The lack of materials handling equipment causes congestion of supplies, delays the movement and striking below of cargo and raises fatigue level. View on the USS SALEM (CA-139) 31 May 1955. NSRDF Neg. No. 323-3.

Fig. 10. - The long white line. In order to meet the standards of the Commander, Sixth Fleet for underway replenishment operations, the use of manpower alone is not enough. View on the USS SALEM (CA-139) 31 May 1955. NSRDF Neg. No. 323-5.

Fig. 11. - Demonstrating the excessive use of manpower when materials handling equipment is lacking. NSRDF Neg. No. 309-80.

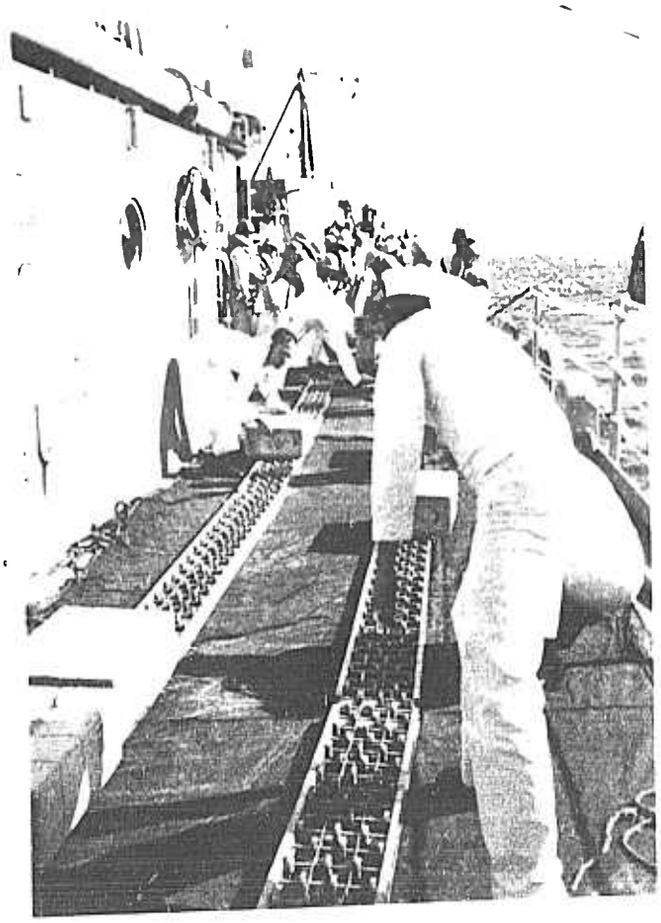


Fig. 12. - The application of lightweight conveyors on the main deck of the USS SALEM (CA-139) moving supplies from the segregation point to the striking zone. Note the comparative use of manpower in this view and Figs. 10 and 11. NSRDF Neg. No. 309-54.

Fig. 13. - View on the main deck of the USS SALEM (CA-139) showing the application of lightweight conveyors. NSRDF Neg. No. 309-31.

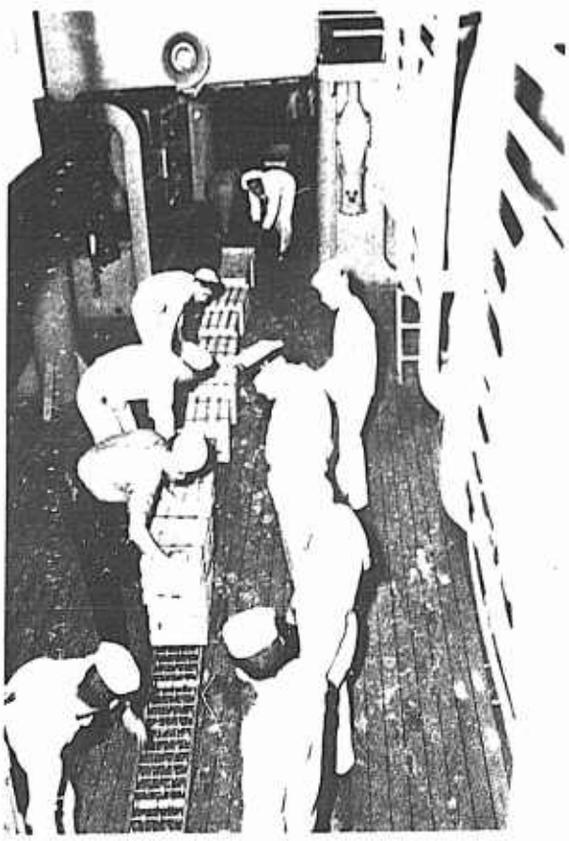


Fig. 14. - Showing the ease with which packages are moved on the free running wheels. NSRDF Neg. No. 323-6.

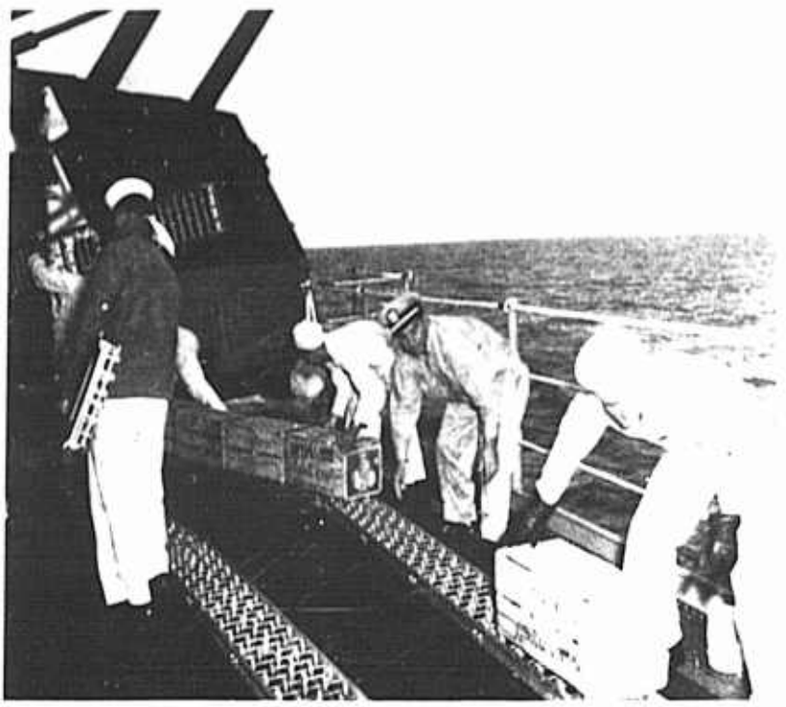


Fig. 15. - Shifting the line. View showing the ease with which the lengths of conveyor can be moved. Note men carrying lengths of conveyor. NSRDF Neg. No. 309-45.

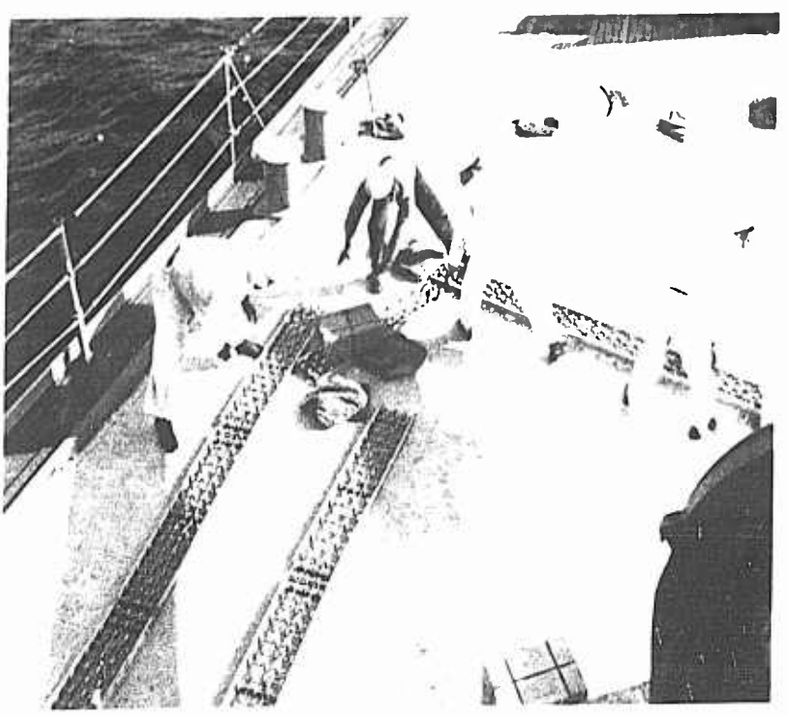


Fig. 16. - Showing the overlapping of conveyors and the elimination of 45° and 90° fabricated turns. NSRDF Neg. No. 309-29.

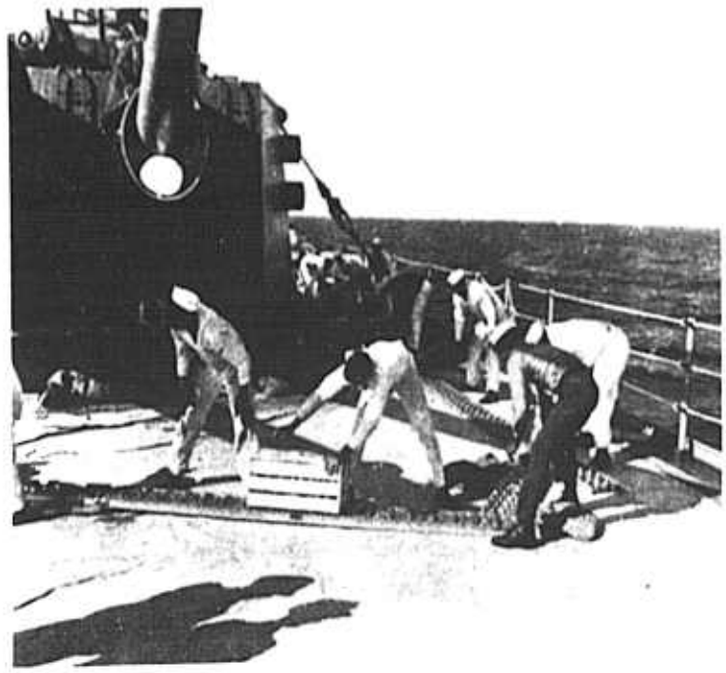


Fig. 17. - The turn. Another view of the overlapping of the conveyor lengths avoiding the use of fabricated turns. NSRDF Neg. No. 323-2.

Fig. 18. - Showing the application of lightweight conveyors to effect the lateral movement of supplies through superstructures. NSRDF Neg. No. 323-4.

TELESCOPIC ALUMINUM CHUTES WITH RETARDENT TAPE

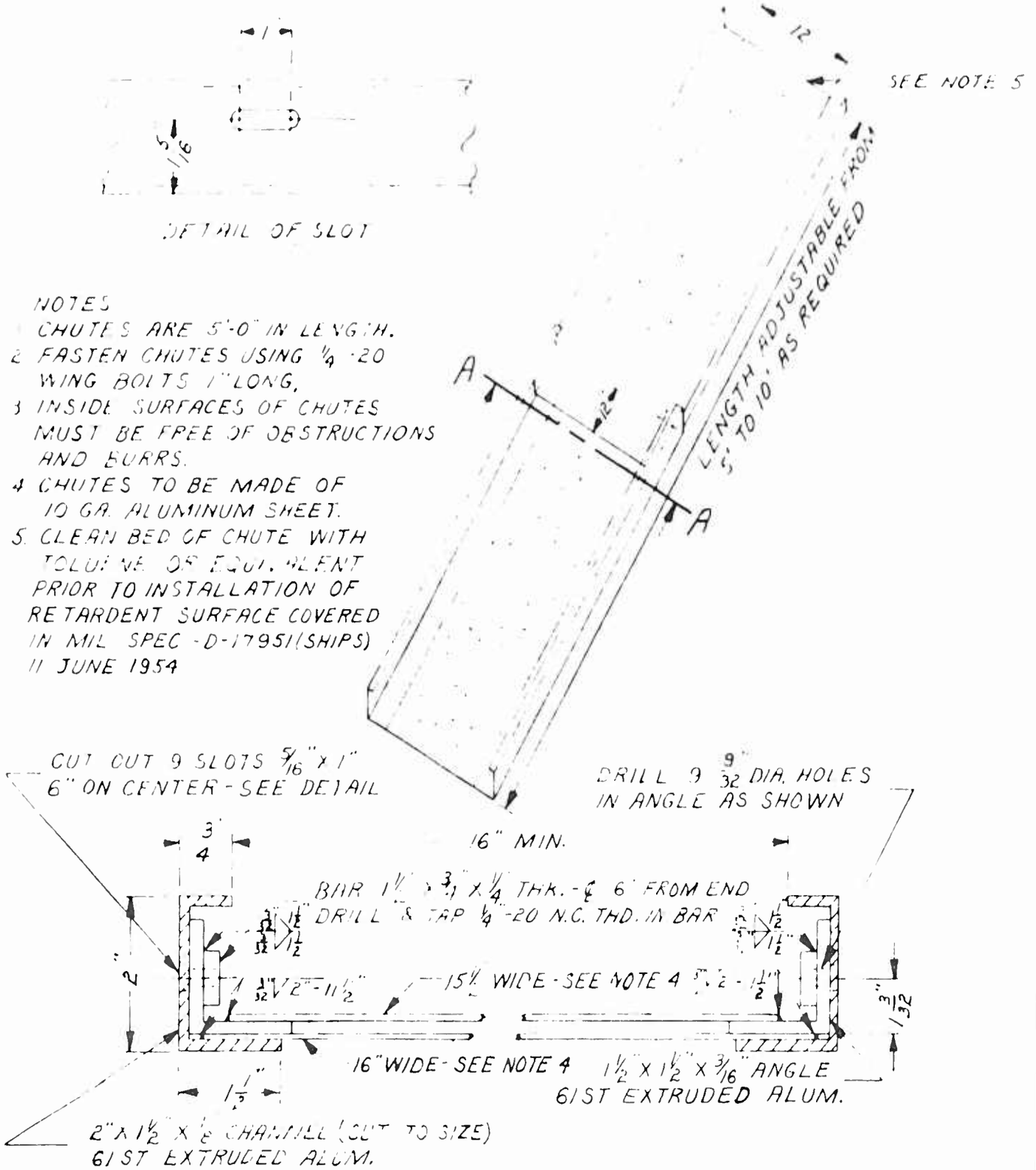
Due to differences in deck heights it was deemed advisable to design a chute that would fit the particular requirements of combatant ships. It would have to be of light weight, readily adjustable, and easily handled.

The final result of these considerations was a chute that evolved in the form of a two section unit. Each chute was designed to be assembled in two parts, one section sliding over the other and provisions were made to secure these sections at any desired length, thus forming a rigid chute. (See Fig. 19).

Construction throughout was of aluminum. The chute in most cases, although not necessarily, rests directly on ladders passing down from deck to deck. Lashing rings are provided at several places along the side of the chute to permit lashing to the ladder. In this connection the chute can be stowed after use by simply lashing it to the reverse side of the ladder.

In order to retard the excessive package speed that develops because of the steep incline of ladders a special retarding surface is attached to the bed of the chute. (Military Specification MIL-D-17951(SHIPS), 11 June 1954, Deck Covering, Lightweight, Non-Slip, Silicon Carbide Particle Coated Fabric, and Beading Sealer).

The skillful use of these chutes, eleven in number, in the USS SALEM (CA-139) in conjunction with the aluminum lightweight type skate wheel gravity conveyor, demonstrated the ability of such equipment to speed stowage operations considerably, while requiring only a minimum of personnel. (See Figs. 20, 21, and 22).



SECTION A-A

TELESCOPIC CHUTE

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DATE: 7-1-55	DWG. NO.-SED-SK-536A

Fig. 19

Fig. 20. - Showing the start of the cargo flow to the below decks stowerooms. Note the lashing rings on the chute. NSRDF Neg. No. 290-6.

Fig. 21. Showing the use of the telescopic metal chute in the USS SALEM (CA-139). Speed of container is reduced to such an extent that man at bottom readily lifts it off chute and transfers to adjacent sailor at about waist height. NSRDF Neg. No. 309-42.

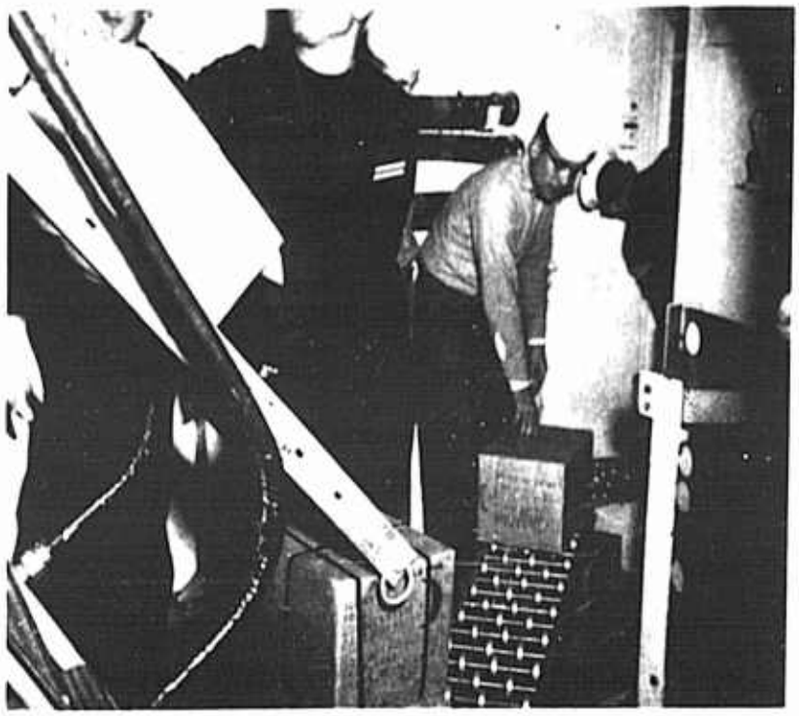


Fig. 22. - The use of the telescopic chute in conjunction with the aluminum lightweight skate wheel gravity conveyor below main deck. NSRDF Neg. No. 309-49.

VERTICAL CANVAS BAFFLE RETARDENT CHUTE

This unit of equipment is the result of an original concept by CAPT E. D. Stanley, Jr., Logistics Officer for the Commander, Sixth Fleet, and was successfully developed by the U. S. Naval Supply Research and Development Facility for use with units of the Sixth Fleet.

The chute is tailored to fit the particular dimensions of the hatch opening where it is used providing the width of the chute is not less than 27 inches and preferably wider to eliminate jamming.

The principle involved in the operation of the Vertical Canvas Baffle Retardent Chute is to have the velocity of the falling package retarded through a succession of small drops. (See Fig. 23). The flexibility of the canvas construction will permit absorption of some of the forces of impact. Partitions placed alternately within the frame of the chute act as baffles to retard the package speed. Openings are provided along the length of the chute for the insertion of steel delivery chutes of the appropriate deck levels. These steel delivery chutes, however, were not used in the USS SALEM, since it was found that limited space at the lower deck level was not conducive to good operation. The length of the sections is approximately ten feet. Additional sections may be readily added to the basic unit. A pipe frame holds the chute open at the upper level for proper entry of the containers and provides the means of support.

These chutes were used in the USS SALEM during Log-Rep 11 and were of the following dimensions:

29" x 34" x 40'
29" x 34" x 33'
29" x 34" x 16'

All were used successfully. Figs. 24 through 28 illustrate the use of the chute aboard the USS SALEM.

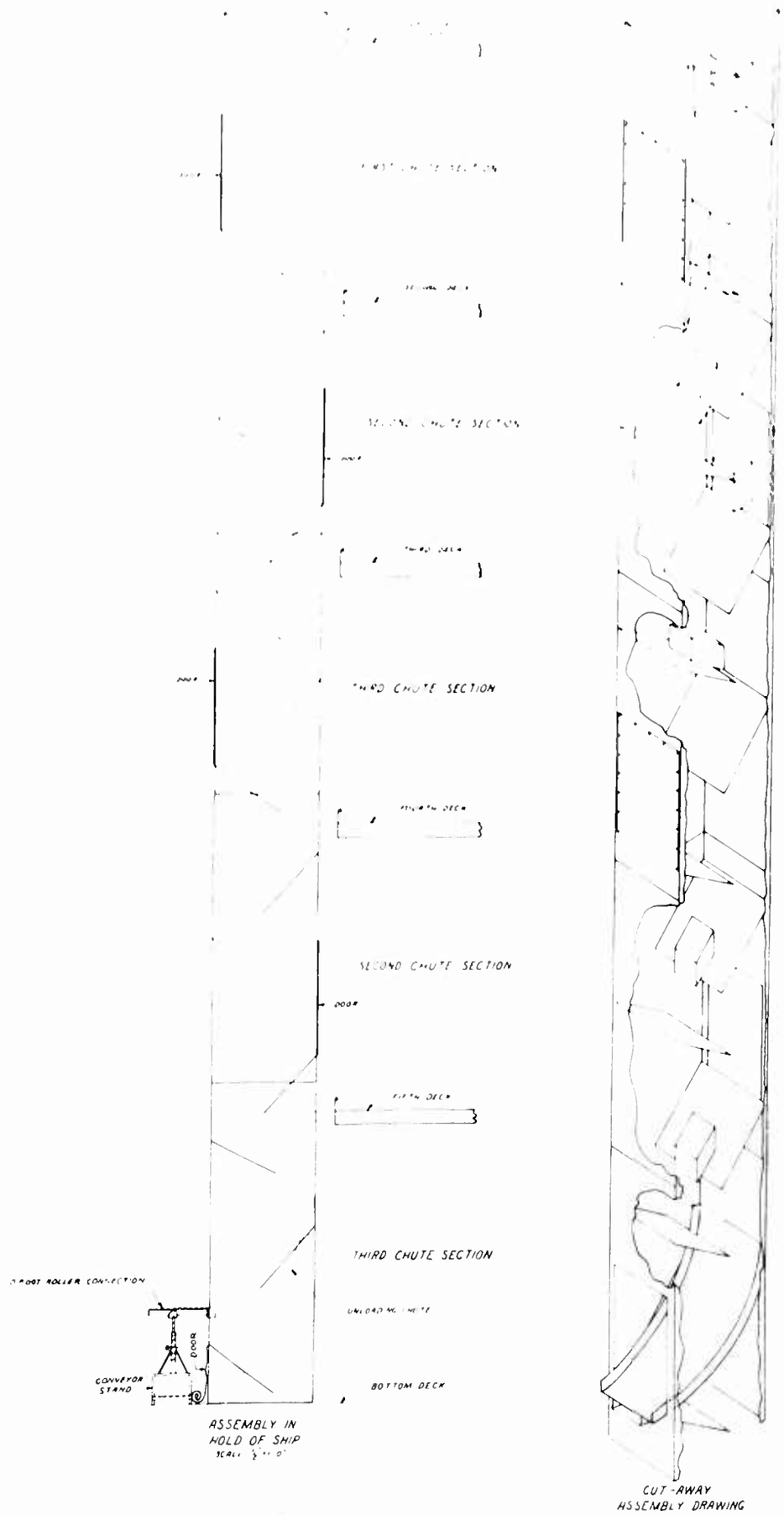


Fig. 23. - VERTICAL CLOTH CHUTE

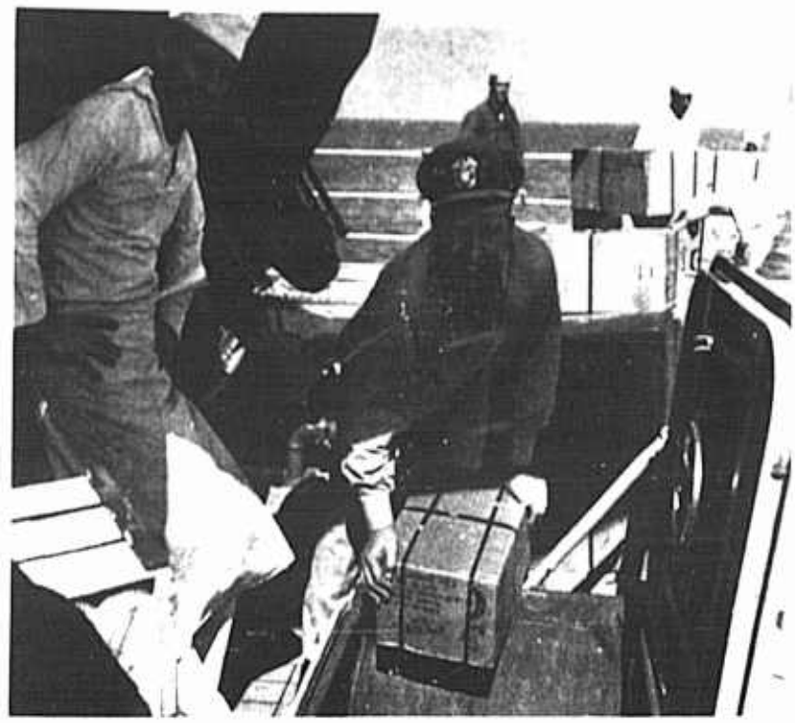


Fig. 24. - View of the use of the vertical canvas chute from the main deck of the USS SALEM (CA-139). Packages were dropped a distance of 40'. NSRDF Neg. No. 309-26.

Fig. 25. - View showing the use of the vertical canvas chute. Note the method of support; pipe frames inserted through openings at the upper deck level provide the opening and the support. This particular chute discharged four decks below. NSRDF Neg. No. 309-24.

Fig. 26. - Showing the use of the vertical canvas chute in conjunction with the aluminum lightweight skate wheel gravity conveyor. NSRDF Neg. No. 309-35.

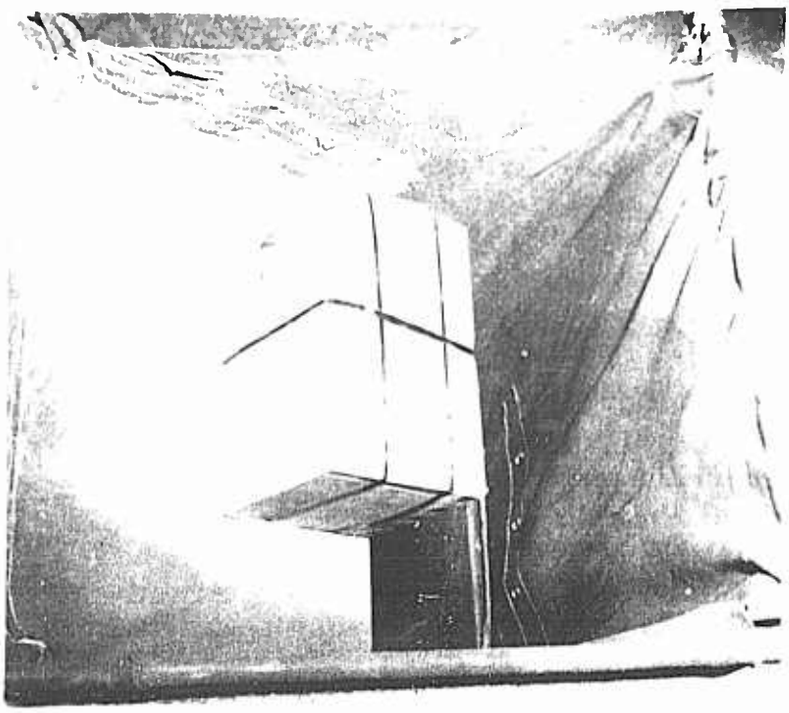


Fig. 27. - View of package dropping to the first of a succession of small drops retarding the velocity of the falling package. NSRDF Neg. No. 309-51.

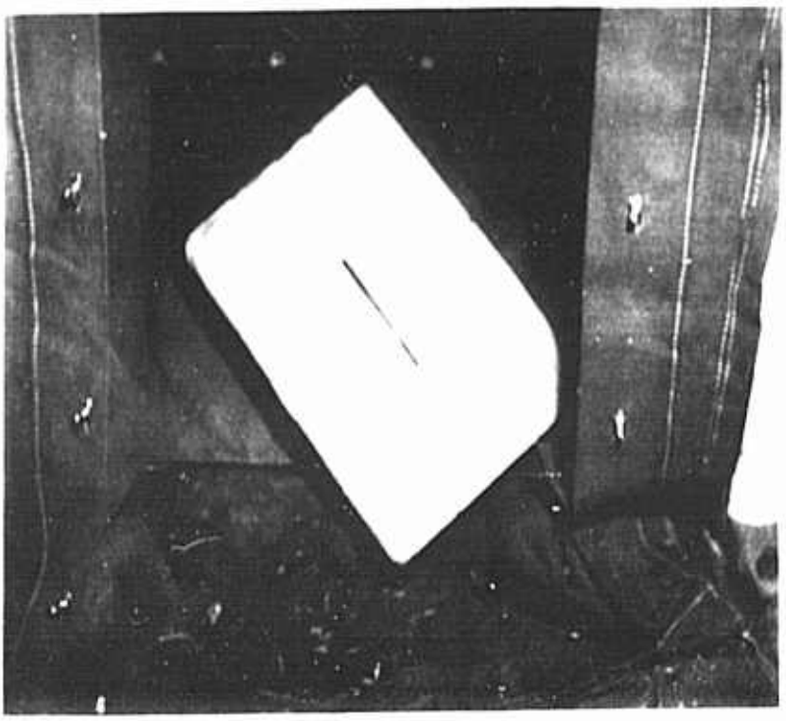


Fig. 25. - The discharge point. Note that steel delivery chutes were not in use during this operation. NSRDF Neg. No. 309-73.

CONCLUSIONS

Vertical Tray Lift Conveyor

This unit was subjected to extensive tests, and was in operation daily for short periods of time for over two months in the USS SALEM (CA-139) and its performance should be considered as highly satisfactory. Geared to operate at sixteen trays per minute, or forty-eight tons per hour, it demonstrated its value as a labor and time saving device by eliminating alternating shifts of men who hoisted crates manually by line to the 02 level, and in operation, delivered crates to the 02 level simultaneously upon receipt. When it is considered that from five to six hours were required to stow approximately thirty tons by manual labor formerly, and that the unit eliminated this time factor, then it should be considered that the results were satisfactory.

Aluminum Lightweight Skate Wheel Gravity Conveyors

These units, efficiently assembled, and intelligently utilized, permitted a reduction in personnel working cargo from 950 to 450, maintained a constant pattern flow from receiving points to striking zones and, for the first time during the underway replenishment operation, permitted the USS SALEM (CA-139) to achieve the standards desired by the Commander, Sixth Fleet, for the replenishment evolution.

Telescopic Aluminum Chutes

The tests of the telescopic metal chute with abrasive retardent material in the USS SALEM (CA-139) were considered highly satisfactory.

Heretofore, each package was carried individually down the ladders to the point of stowage. The use of the chute eliminates excessive manpower and is an outstanding time saving unit.

Canvas Baffle Retardent Chute

The use of these chutes in the USS SALEM (CA-139) is considered a qualified success.

It is noted that on occasion packages have a tendency to jam at the drop points, despite the flexibility of the canvas to absorb some of the force of impact.

Furthermore, under constant usage, it is noted that canvas is subject to rapid wear and tear, and poses the problem of repairs after long usage.

RECOMMENDATIONS

Vertical Tray Conveyor

Certain modifications to the unit should be considered. Inner guards were fabricated by the members of the ship's company of the USS SALEM (CA-139) and were extremely successful in protecting the drive chain, particularly in the loading and unloading of potatoes which had been sacked instead of crated.

It is recommended that these guards be incorporated in future designs and fabrications of the unit.

Aluminum Lightweight Skate Wheel Gravity Conveyors

These tests in the USS SALEM (CA-139), and previous tests with other units of the lightweight aluminum skate wheel gravity conveyor, have confirmed opinions that such assemblies are a vital part of equipment for ships engaged in the underway replenishment evolution. It is recommended, therefore, that such conveyors be added to the allowance lists of all combatant vessels in such quantities as may be considered necessary.

Telescopic Aluminum Chutes

It is recommended that the curved portion previously used in steel chute designs be eliminated where possible. It is also recommended that such chutes be added to the allowance lists of combatant vessels in such quantities as may be considered necessary.

Canvas Baffle Retardent Chute

It is noted that the Naval Supply Research and Development Facility is continuing development work on this item. Nylon cloth impregnated with neoprene is being tested as a substitute for canvas and is expected to be stronger, lighter, and occupy less cube. Hatch dimensions which limit desirable larger widths of the chutes cause present jamming trouble occasionally, but future developments may decrease this difficulty. These new units should be evaluated in future replenishment exercises prior to design standardization.

Finally, it is recommended that the Underway Replenishment Bill be taken into consideration as a matter of paramount military importance. The Underway Replenishment Bill of the USS SALEM (CA-139), a facsimile of which is reproduced in this report as Appendix A, expresses the ultimate in such bills for combatant ships of this type. It was prepared and written by LCDR George C. Nelson, SC, USN, Supply Officer of the USS SALEM (CA-139) and under the direction of CDR Edward M. Luby, USN, the Executive Officer. Prior to the underway replenishment evolution, training exercises were held by order of the Commanding Officer of the USS SALEM (CA-139), CAPT J. MacGinnis, USN, and all concerned were exercised and briefed in their respective duties at their particular stations.

From an operational point of view the replenishment operation itself was an unqualified success, and part of this success was due to the procedures and methods as outlined in the Replenishment Bill. It is felt that the Replenishment Bill of the USS SALEM (CA-139) could well be used as the basis for other such bills on combatant ships of this type.

APPENDIX A

THE UNDERWAY REPLENISHMENT BILL OF THE USS SALEM (CA-139)

U. S. S. SALEM (CA-139)
c/o Fleet Post Office
New York, N. Y.

U. S. S. SALEM INSTRUCTION 4000.2 23 May 1955

From: Commanding Officer
To: Distribution List "A" and "G"

Subj: Replenishment Procedure; publication of

Encl: (1) Main Deck Diagram of Conveyor and man lines with hatch designations by type of stores.
(2) Below Decks Diagram of stores routing lines with storerooms layout forward.
(3) Below Deck Diagram-Aft, Starboard.
(4) Below Deck Diagram-Aft, Port.
(5) Alphabetical Item listing of storeroom assignment and route desired description.
(6) Stores routing plan for topside sorting areas.
(7) Assignment of Personnel plan.

1. Purpose. The purpose of this instruction is to promulgate the replenishment at sea procedure.

2. Objective. The objective of this instruction is to delineate lines of responsibility, assign personnel to specific tasks, and provide topside and below decks routing information for the stores received so as to effect replenishment at sea with the maximum of speed and efficiency with minimum employment of personnel in the evolution while simultaneously maintaining a state of combat readiness approximating that of "general Quarters."

3. Discussion. The military necessity of effecting replenishment at sea while simultaneously maintaining an adequate defensive and offensive

position is well recognized. In the case of receiving ship the requirement is that the ship be organized to replenish at sea rapidly, accepting cargo at the rate transferred by the delivering ship; and also that the cargo be sorted, segregated and struck below at about the same rate as the cargo is received, while simultaneously maintaining a state of combat readiness approximating that of "general Quarters." The most effective method of accomplishing this desired readiness position appears to be to utilize to the maximum the material handling aids (Chutes, conveyors, and tray lift) which are available at this time. This procedure is designed to accomplish the above objective.

4. Procedure: (a) While in the replenishment formation about three quarters of an hour before scheduled alongside and not later than the time of departure from the waiting line, the ship will go to General quarters and set Replenishment Zebra. Damage control parties will make necessary reports to Central Control.

(b) After setting Replenishment Zebra the ship will "Man Replenishment Stations." At this command all personnel will stand fast at General Quarters except personnel who have replenishment stations as outlined in enclosure (7).

(c) After personnel who are assigned replenishment stations have been mustered, the Gunnery Officer will report "Topside stations manned", and Supply Officer will report, "Below Decks stations manned."

(d) Materials handling equipment will be rigged as soon as possible after mustering personnel at replenishment station.

(e) Stores will be dropped at the Receiving Stations designated in enclosure (1) where the "Topside Replenishment personnel" under the direction of the Gunnery Officer will unload nets, transfer to sorting areas, move the material along the flow pattern designated in enclosure (1) to the striking zones where it will be accepted by the "Lower Deck Replenishment personnel" under the direction of the Supply Officer. The stores will be moved to storerooms in accordance with the flow pattern outlined in enclosures (2) through (4). Enclosures (5) and (6) are to be utilized by supervisors in the sorting areas, through the flow pat-

tern, and in the storerooms to determine the proper distribution of stores for stowage in appropriate areas and storerooms. Material should be moved expeditiously on the main deck, in the trunks and passageways to avoid collection of stores topside and to keep the drop points and striking zones from becoming congested.

(f) Supply Department personnel under the supervision of the Stores Officer, or Ships Store Officer will direct the flow of stores to the proper striking zones and will control the orderly movement of stores to below-deck spaces through the use of striking zones check lists.

5. Responsibilities. The area of responsibilities to effect the above plan is as follows:

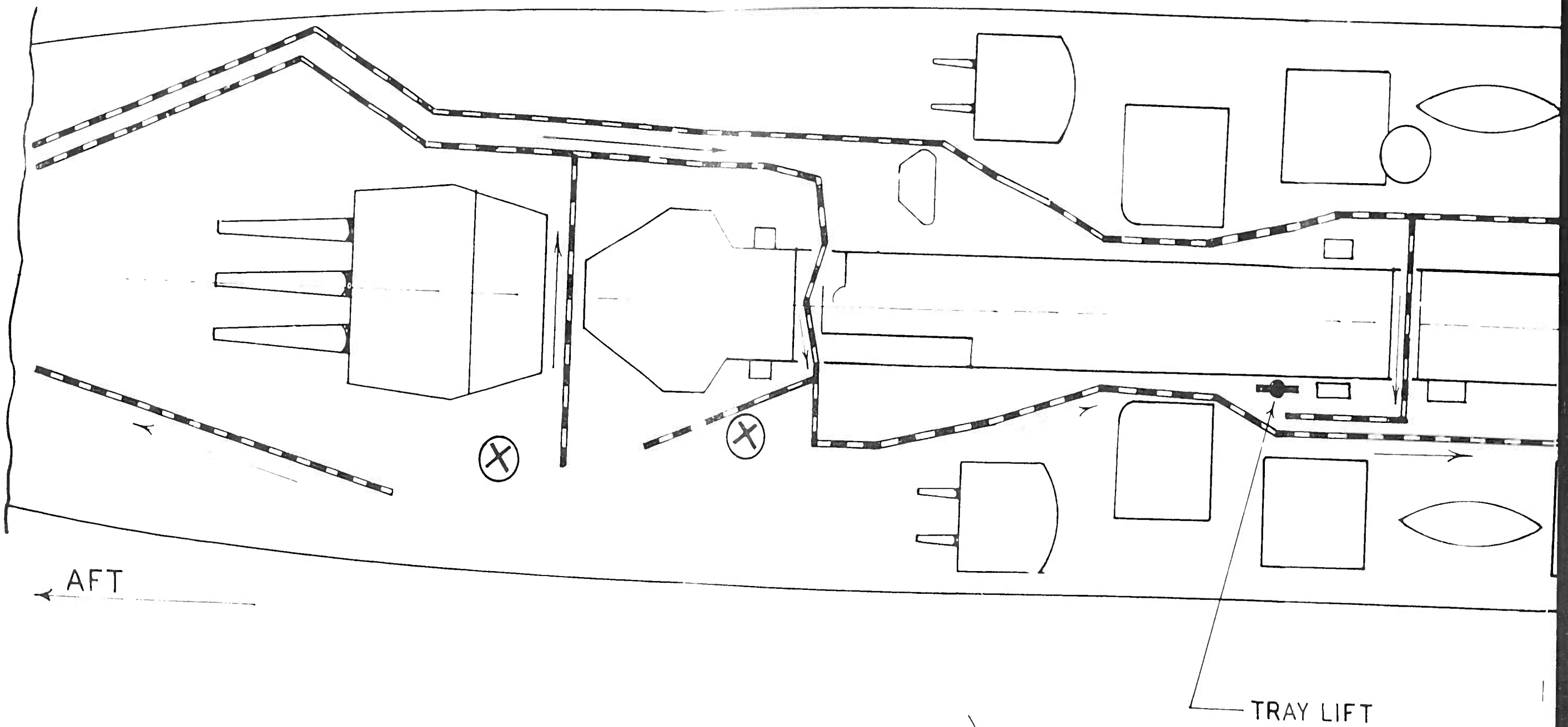
a. Engineer Officer - Lighting for night replenishment, setting and resetting Condition Zebra.

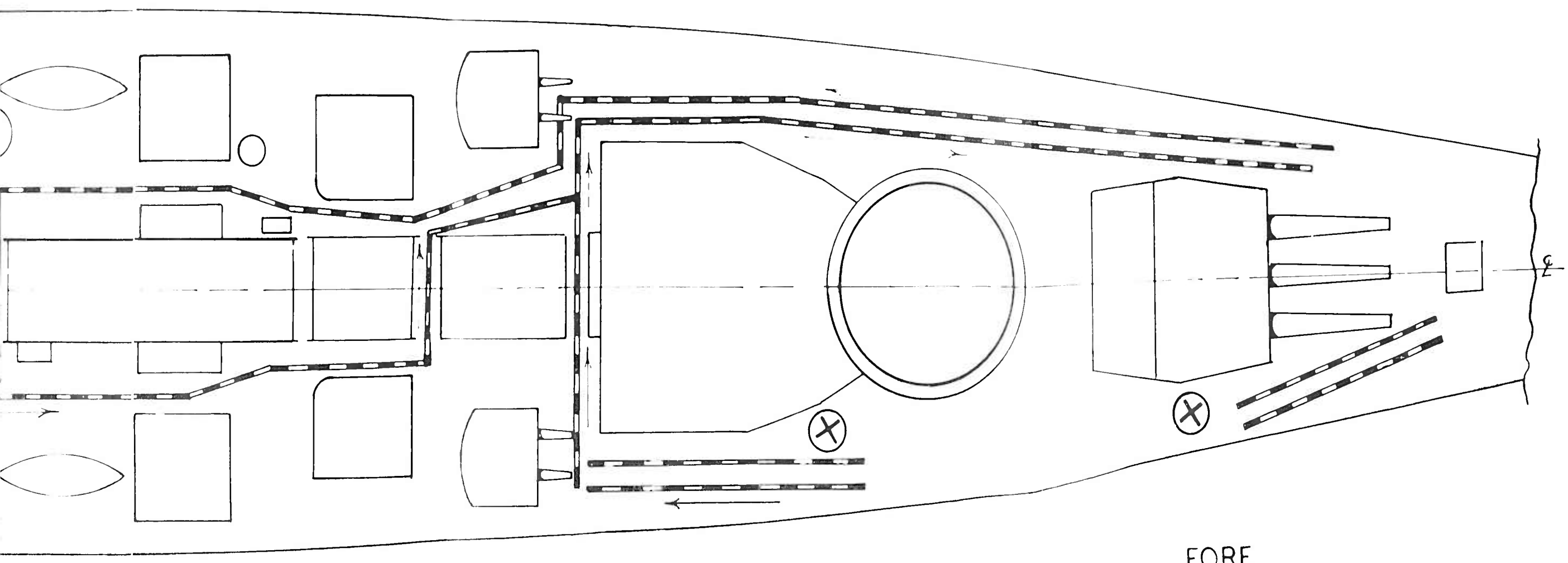
b. Gunnery Officer - Assignment of Personnel on Main Deck, overall responsibility for rigging and unrigging replenishment Receiving Stations, setting topside conveyors, and handling of stores topside.

c. Supply Officer - Assignment of replenishment personnel below decks, rigging below decks conveyors and chutes, handling of stores below decks, and checking for quantity received. Flow pattern supervisors topside are Supply Department Personnel.

6. Cancellation. This instruction will remain in effect until cancelled.

J. MAGINNIS


AFT
TRAY LIFT



FORE

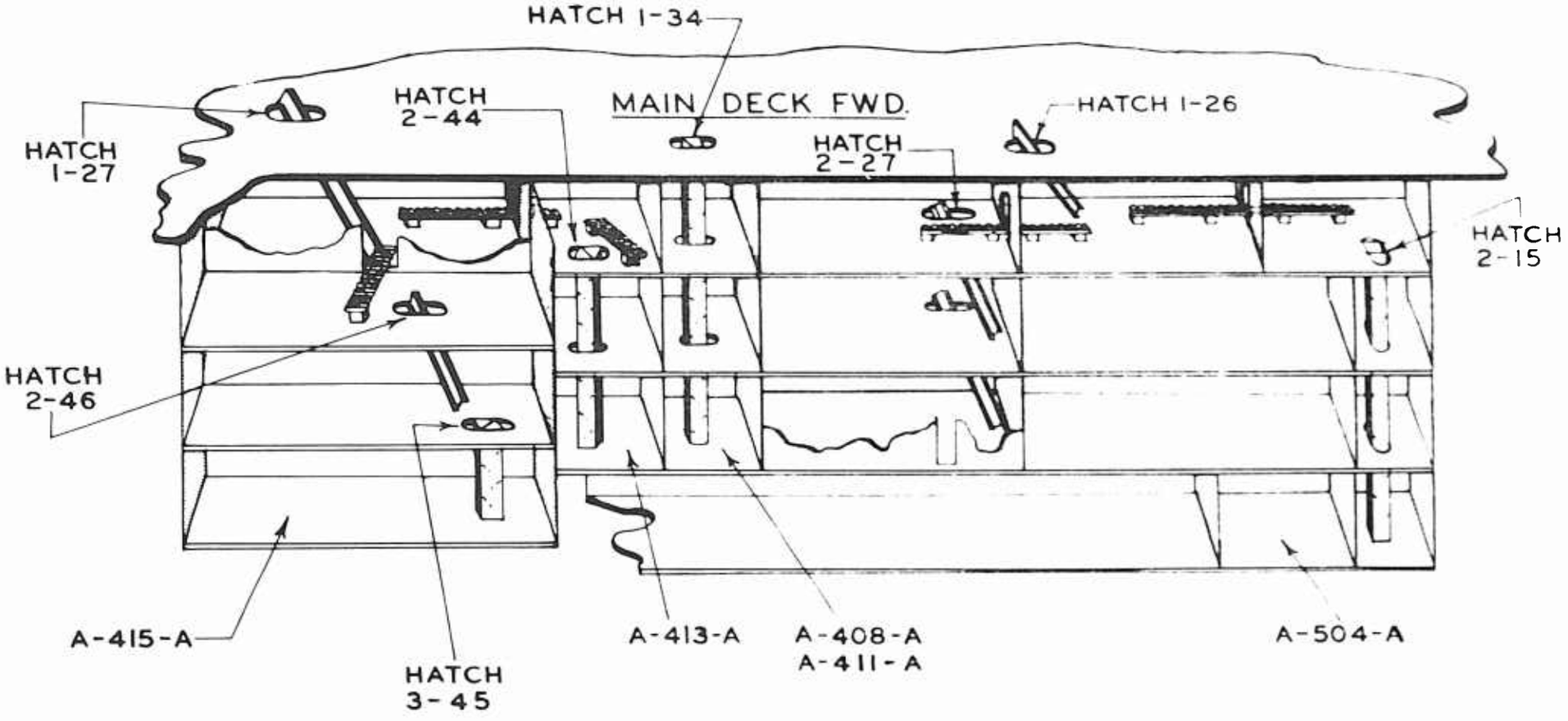
CONVEYORS

SCALE 5/8 = 10

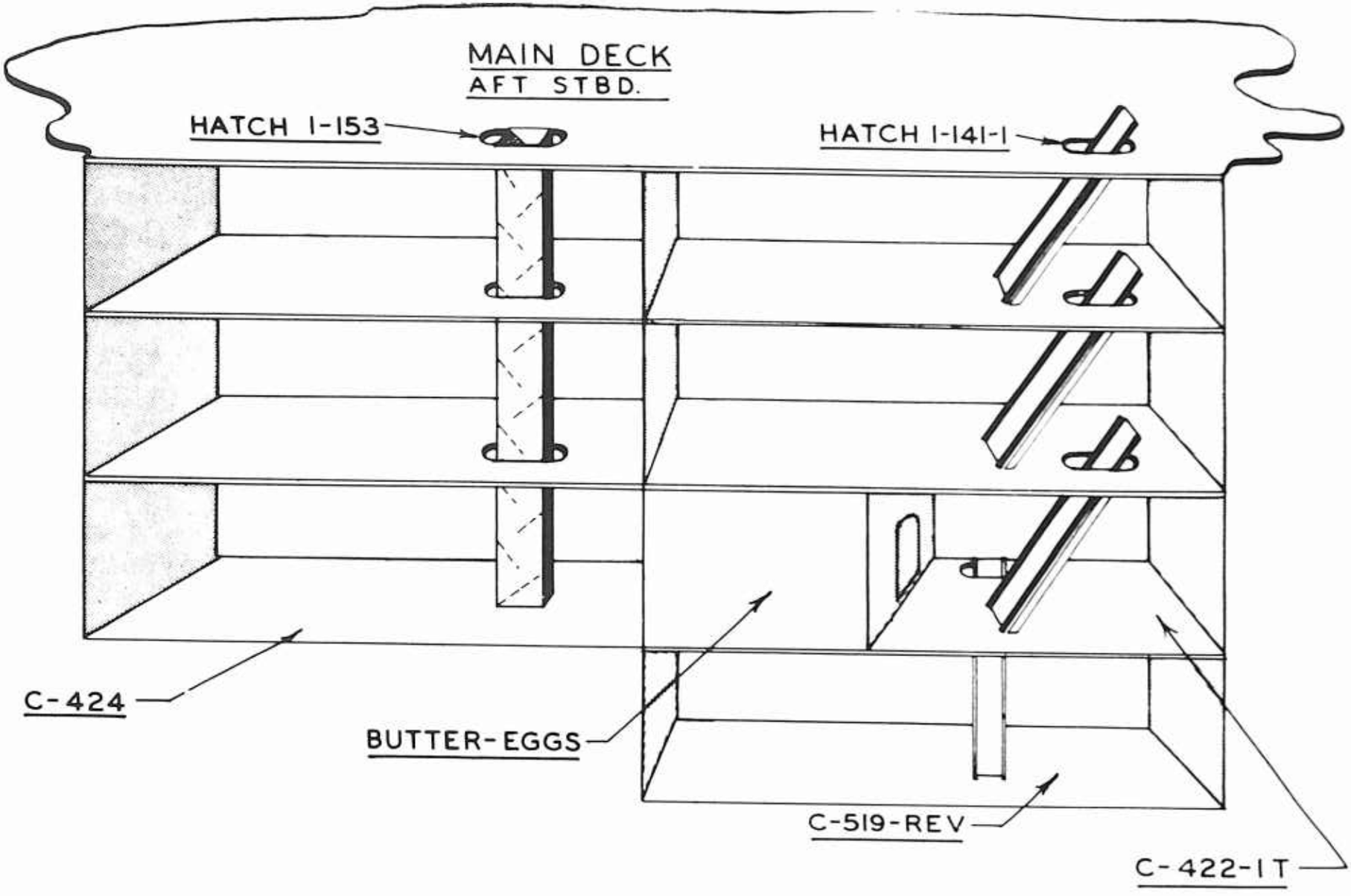
2

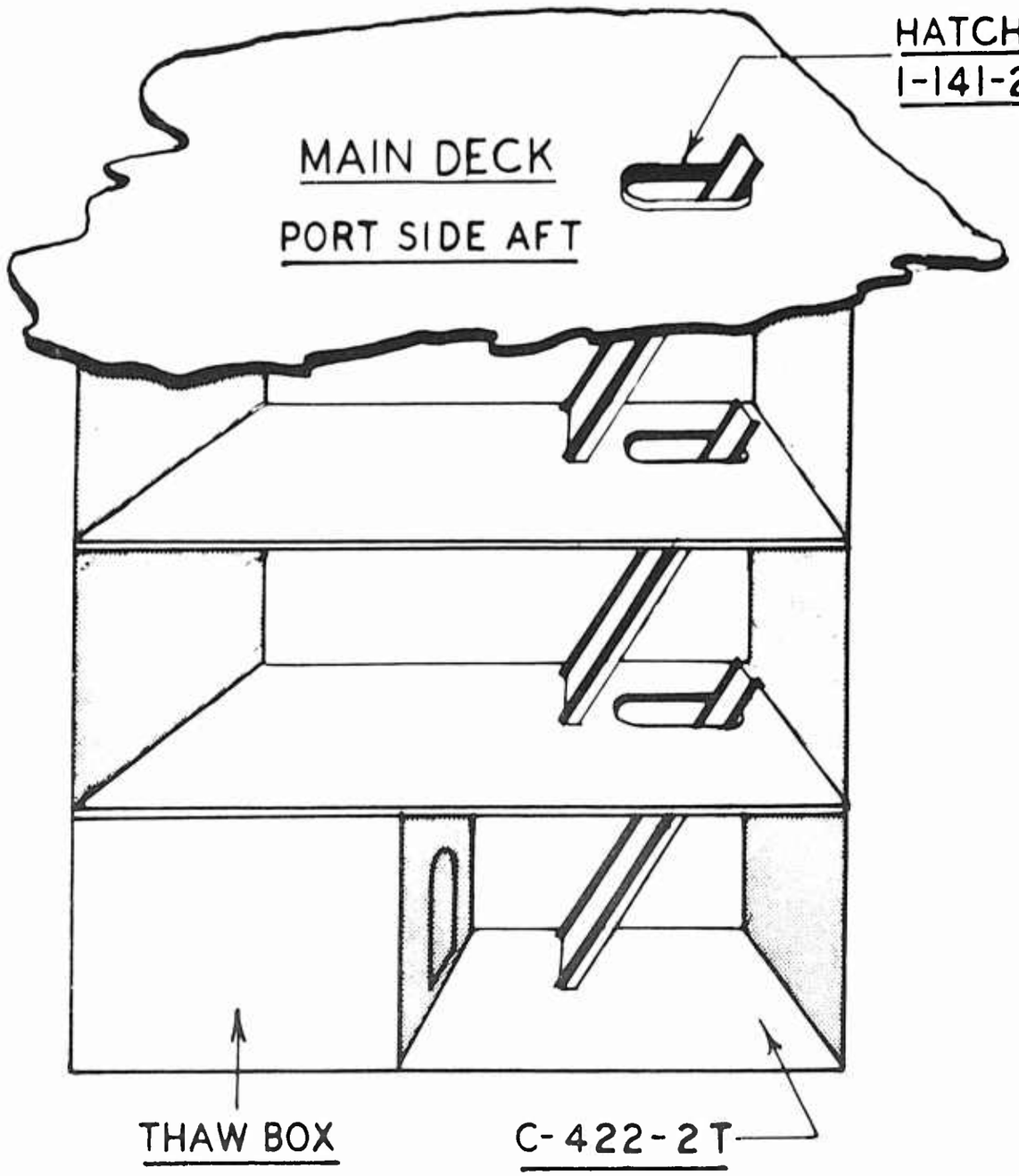
ENCLOSURE (1)

ENCLOSURE (2)


HATCH 1-34
MAIN DECK FWD.
HATCH 2-44
HATCH 1-26
HATCH 1-27
HATCH 2-27
HATCH 2-15
HATCH 2-46
A-415-A
HATCH 3-45
A-413-A
A-408-A
A-411-A
A-504-A

ENCLOSURE (3)


MAIN DECK
AFT STBD.
HATCH 1-153
HATCH 1-141-1
C-424
BUTTER-EGGS
C-519-REV
C-422-1T


HATCH
I-141-2
MAIN DECK
PORT SIDE AFT
THAW BOX
C-422-2T

ROUTING OF MATERIAL TO DESIGNATED AREAS AND STOREROOMS

1. The ship is divided into two provisioning areas as follows:
Area-I-Forward Main Deck Area II Aft Main Deck

STOREROOMS	REACHED BY HATCH	ITEMS STORED IN STOREROOMS
A-504-A A-605-172-A	1-26 Place stages on ladder for slide on 2nd deck use conveyors to move stores forwarded to windlass room to hatch 2-25	Catsup Tinned, Catsup Bottled, Cereal, Eggs Powdered, Onion Dehyd., Potatoes Dehyd., Mayonaise, Shortening, Spices
A-406-A	1-34 Slide stores to storeroom thru hatch 2-25	A-1 Sauce, Macaroni, Mixed Olives, Mushrooms Canned, Noodles, Spaghetti, Vinegar
A-408-A A-411-A	1-34 Slide to storeroom by canvas chute thru hatch 2-44	Coffee, Milk-Evaporated, Milk-Powdered, Puddings Assorted, Pumpkin, Sugar
A-413-A	1-46 Slide to storeroom by canvas chute thru hatch 2-44	Asparagus, Bacon Tinned, Beans-String, Beets, Beef Roasted, Carrots, Chicken, Corn, Corned Beef Tinned, Corned Beef Hash, Eggs Powdered, Hamburgers Tinned, Ham-Chunks Tinned, Luncheon Meat, Peas, Pimentoes, Pork Sausage Tinned, Potatoes Sweet, Salmon, Sauerkraut, Spinach, Tomatoes, Tomato Paste, Tomato Puree, Tuna Fish, Turkey
A-415-A	1-46 Slide to 2nd deck use roller conveyors to move stores in CPO Quarters lower to storeroom	Apples Tinned, Applebutter, Applesauce, Apricots, Blueberries, Cherries, Figs, Fruit Cocktail, Grapefruit Sections, Gelatin, Jam Assorted, Jelly, Assorted, Mincemeat, Peaches, Pears, Pineapple, Prunes, Salad Oil

[illegible]	[illegible]	ITEMS STORED IN STOREROOMS
[illegible]	[illegible]	Baking Powder, Beverage Base, Blended Juice, Baking Soda, Cocoanut, Cocoa, Cranberry Sauce, Grapefruit Juice, Milk-Medo, Mustard, Orange Juice, Peanut Butter, Pickles, Raisins, Tea, Tomato Juice, Vanilla
[illegible]	[illegible]	Frozen Fish, Frozen Fruits, Frozen Meat, Frozen Milk, Smoked Ham and Bacon
[illegible]	[illegible]	Butter, Cheese, Eggs, Fruits, Jams, Jellies
[illegible]	[illegible]	[illegible], Beans, Beans-Kidney, [illegible], [illegible], Cornmeal, [illegible], Flour, Hominy, [illegible], [illegible], Salt, Salt Bacon, Starch-Powdered, [illegible]

STORES ROUTING PLAN FOR LOG-REP

Applebutter	Mushroom s Canned	"
Applesauce	Noodles	"
All Spices	Onion Dehyd.	"
Cereal Dry	Potatoes Dehyd	"
Eggs Dehyd.	Shortening	FORECASTLE
Chili Sauce	Spaghetti	"
Garlic Salt	Soy Sauce	"
Jam Assorted	Worcestshire Sauce	"
Macaroni	Vinegar	"

Coffee	TURRET #1
Milk Evaporated	HATCH DIRECTLY UNDER
Milk Powdered	GUN BARRELS
Pudding Assorted	
Sugar Granulated	

Apples Canned	Luncheon Meat	"
Apricots Canned	Molasses	"
Bacon Canned	Peaches	"
Beef Roasted Td.	Pears	"
Beef Canned	Pineapple	"
Blueberries Td.	Pork Sausage Td.	PORT SIDE OF
Cherries Canned	Potatoes Sweet Td.	TURRET #2
Corned Beef Td.	Prunes	"
Corned Beef Hash	Salad Oil	"
Corn Td.	Salmon	"
Cranberry Sauce	Sauerkraut	"
Figs Td.	Fruit Cocktail	"
Grapefruit Sections	Tomatoes	"
	Tomatoes Paste	
	Tomatoes Puree	

STORES ROUTING PLAN FOR LOG-REP (Cont'd)

Baking Powder	Milk-Medo	"
Butter	Pickles-All	"
Cheese	Raisins	AFT OF TURRET #3
Eggs	Tea	HATCH 1-140-1
Juice Orange	Vegetables Fresh	STARBOARD SIDE
Juice Blended		
Juice Pineapple		
Juice Tomato		

FROZEN Fish, Fruits, Meats — AFT OF TURRET #3 HATCH 1-140-2

Barley	Salt Table	"
Beans, Blackeyed	Peas-Split	"
Beans-Kidney	Sugar-Brown	"
Beans-White Dry	Sugar-Powdered	HATCH 1-153
Cornmeal	Syrup	ON FANTAIL
Crackers	Yeast	"
Rice		"
Rolled Oats		"

PERSONNEL ASSIGNMENT

1. Topside Assignment (Gunnery Department)

Replenishment Detail	Manned From	With Men	Report To
Drop Station #1	Turret #1	30	
Drop Station #2	Turret #2	30	
Drop Station #3	Mt. #55	30	
Drop Station #4	Turret #3	30	
Carry Line From Station #3	Mt. #55	6	
Carry Line From Station #3	Mt. #39	20	
Carry Line From Station #3	Engineers 1	10	
Carry Line From Station #4	Turret #3	19	
Carry Line From Station #4	Engineers	10	
Carry Line From Fr. 97 Port	Mt. #35	24	
Carry Line From Fr. 97 Port	Mt. #37	22	
Rollers Fr.	Turret #1	8	
Rollers Fr. 55 to 67 Stbd	Turret #2	8	
Rollers Fr. 32 to 68 Port	Mt. #35	28	
Rollers Fr. 67 Athwartship	Engineers	8	
Rollers Fr. 67 to 95 Port	Mt. #33	12	
Rollers Fr. 94 Athwartship	Mt. #33	2	
Rollers Fr. 94 to 98 Stbd	Engineers	2	
Handling Detail:	Turret #1	8	
Forecastle	Turret #2	8	
Frame 46 C/L	Engineers	4	
Spud Hoist			
	Total	319	

2. Topside Assignment (Supply Department) Checkers and Routing Supervisors

Responsibility	Rating	No.
Receive Invoices-Transmit Reqn. and Messenger	SK	1
Loading Station #1 Sorting Supervisor	CHPCLK	1
Sorting and Routing Supervisor Forward	CS	3
Sorting and Routing Supervisor Forward	SK	3
Routing Supervisor Midships Port	SK	1
Loading Station #2 Sorting Supervisor	LTJG-SC	1
Sorting and Routing Supervisor Aft.	SH	1
Sorting and Routing Supervisors Aft	CS	5
Sorting Areas Supervisor Aft Mt. #54	SH	1
Sorting Areas Supervisor Aft Mt. #54	SK	1
Potato Lift 02 Level Stowage Supervisors	CS	2
Loading Station #3 Sorting Supervisor	CHPCLK	1
Loading Station #4 Sorting Supervisor	LTJG-SC	1
Spud Locker 02 Level	SK	4
	Total	26

3. Second Deck Assignment (Supply Dept.)

Responsibility	Rating	No.
Mess Hall #3 Portside	SK	1
Mess Hall #3 Starboard Side	SK	1
Port Side Passageway - Chiefs Mess	SK	1
Starboard Side Passageway - Supply Office	SK	1
Starboard Side Passageway - Issue Room	SK	1
Portside Passageway - Soda Fountain	SK	1
Passageway - Turret #1	SK	1
Passageway - Hatch 2-27	CS	2
		2

4. Storeroom Assignment (Supply Office)

Responsibility	Supervisor	Working Party
A-406-A		
A-504-A	1 CS	11
A-602-1/2A	1 CS	5
A-408-A	1 CS	3
A-411-A	1 CS	5
A-413-A	1 CS	5
A-415-A	1 CS	8
C-424-A	1 CS	12
C-519-AE	1 CS	7
Ice Boxes Starboard	1 CS	8
Ice Boxes Port	1 CS	10
		10
	11	84

Summary

Topside Assignment (Gunnery Dept.) - - - -	319
Topside Assignment (Supply Dept.) - - - -	30
Second Deck Assignment (Supply Dept.) - - -	11
Storeroom Assignment (Supply Dept.) - - - -	95
Total No. of men assigned - - - - - - - - - -	455

To Replenishment Stations